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Adaptive control of radiated sound power based on time-domain estimates of acoustic radiation modes (Conference Paper)

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Abstract

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In active structural acoustic control , broadband control of the radiated sound power from a structure can be achieved by minimizing the amplitudes of the acoustic radiation modes (ARMs). The shape of these ARMs is frequency dependent and only a few might radiate significant power in a given frequency range. In this paper a method is described by which the ARMs are estimated in real-time from a number of point response measurements taken on a vibrating structure. These estimates can be used to calculate the radiated power or, here, in a feedforward adaptive control system. Estimates of the ARM amplitudes in the time domain are produced by digitally filtering the outputs of an array of sensors mounted on the radiator. These filters are designed by FIR filters in the frequency domain based on the frequency-dependent ARMs and implemented in the time domain . These estimates are then used as the cost function in a feedforward, adaptive , filtered-X LMS controller. The theory is described with reference to a 2-dimensional vibrating structure. Finally numerical results of real-time simulations are presented.

SciVal Topic Prominence

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Acoustic radiation modes | FxLMS controller | Real-time control

Indexed keywords

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References (10)

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1 Elliott, S.J., Johnson, M.E.
Radiation modes and the active control of sound power

(1993) *Journal of the Acoustical Society of America*, 94 (4), pp. 2194-2204. Cited 394 times.
doi: 10.1121/1.407490

View at Publisher

2 Cunefare, K.A.
The minimum multimodal radiation efficiency of baffled finite beams

(1991) *Journal of the Acoustical Society of America*, 90 (5), pp. 2521-2529. Cited 98 times.
doi: 10.1121/1.402057

View at Publisher

3 Berkhoff, A.P.
Broadband radiation modes: Estimation and active control

(2002) *Journal of the Acoustical Society of America*, 111 (3), pp. 1295-1305. Cited 22 times.
doi: 10.1121/1.1451067

View at Publisher

4 Maillard, J.
(1997) *Advanced Time Domain Sensing for Active Structural Acoustic Control*. Cited 10 times.
Virginia Polytechnic Institute and State University

5 Wu, W.
Analysis of acoustic radiation mode in time domain

(2009) *Science in China, Series E: Technological Sciences*, 52 (8), pp. 2384-2390. Cited 3 times.
doi: 10.1007/s11431-009-0205-2

View at Publisher

6 Nor, K.A.M., Mace, B.R., Hioka, Y.
Time-domain estimation of acoustic radiation modes and active structural acoustic control

(2016) *2nd Australasian Acoustical Societies Conference, ACOUSTICS 2016*, 1, pp. 234-243.
ISBN: 978-151083739-3

7 Mao, Q., Pietrzko, S.
Control of noise and structural vibration: A MATLAB®-based approach

(2013) *Control of Noise and Structural Vibration: A MATLAB®-Based Approach*, 9781447150916, pp. 1-369. Cited 22 times.
http://dx.doi.org/10.1007/978-1-4471-5091-6
ISBN: 978-144715091-6; 1447150902; 978-144715090-9
doi: 10.1007/978-1-4471-5091-6

View at Publisher

8 Sung, C.-C., Jan, C.T.
Active control of structurally radiated sound from plates

(1997) *Journal of the Acoustical Society of America*, 102 (1), pp. 370-381. Cited 20 times.
doi: 10.1121/1.419759

View at Publisher

9 Mace, B.R., Halkyard, C.R.
Time domain estimation of response and intensity in beams using wave decomposition and reconstruction

(2000) *Journal of Sound and Vibration*, 230 (3), pp. 561-589. Cited 25 times.
doi: 10.1006/jsvi.1999.2630

View at Publisher

10 Elliott, S.J.
2 - Optimal and adaptive digital filters
(2001) *Signal Processing for Active Control*. Cited 3 times.
Academic Press, London